

## INTERNATIONAL SEARCH REPORT

International Application No.

PCT/DE2004/002648

A. CLASSIFICATION OF SUBJECT MATTER H01L23/16 H01L21/50 H01L21/60 H01S5/042		
According to International Patent Classification (IPC) or to both national classification and IPC		
B. FIELDS SEARCHED Minimum documentation searched (classification system followed by classification symbols) H01L H01S B23K B61B		
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched		
Electronic data base consulted during the international search (name of data base and, where practicable, search terms used) EP0-Internal		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category *	Citation of document(s), with indication, where appropriate, of the relevant passages	Relevant to claim no.
X	TAO Y ET AL: "INVESTIGATION OF LASER-ASSISTED BONDING FOR MEMS PACKAGING" INTERNATIONAL JOURNAL OF NONLINEAR SCIENCE AND NUMERICAL SIMULATION, FREUND PUBLISHING HOUSE, TEL-AVIV, IL, vol. 3, no. 3/4, 11 August 2002 (2002-08-11), pages 427-431, XP009023464 ISSN: 1565-1339 the whole document	1,2
Y	-----	4-8
X	EP 1 346 949 A (ROBERT BOSCH GMBH) 24 September 2003 (2003-09-24)	1,2
Y	paragraphs [0002], [0010], [0018] - [0023], [0028], [0032] -----	4-8
-/-		
<input checked="" type="checkbox"/> Further documents are listed in the continuation of box C.		<input checked="" type="checkbox"/> Patent family members are listed in annex.
* Special categories of cited documents:		
"A" document defining the general state of the art which is not considered to be of particular relevance		"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"E" earlier document but published on or after the international filing date		"X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"I" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)		"Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"O" document referring to an oral disclosure, use, exhibition or other means		"A" document member of the same patent family
"P" document published prior to the international filing date but later than the priority date claimed		
Date of the actual completion of the international search	Date of mailing of the international search report	
8 September 2005	29.11.2005	
Name and mailing address of the ISA European Patent Office, P.B. 5916 Patentlaan 2 NL - 2280 HV Rijswijk Tel: (+31-70) 340-2940, Tx: 31 661 app no. Fax: (+31-70) 340-3916	Authorized officer Cousins, D	



## INTERNATIONAL SEARCH REPORT

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**Box I Observations where certain claims were found unsearchable (Continuation of item 1 of first sheet)**

This international search report has not been established in respect of certain claims under Article 17(2)(a), for the following reasons:

1. ☐ Claims Nos.:  
because they relate to subject matter not required to be searched by this Authority, namely:
2. ☐ Claims Nos.:  
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:
3. ☐ Claims Nos.:  
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

**Box II Observations where unity of invention is lacking (Continuation of item 2 of first sheet)**

This International Searching Authority found multiple inventions in this international application, as follows:

**see supplemental sheet**

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☒ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims, it is covered by claims Nos.:

1-8

**Remark on Protest**

- ☐ The additional search fees were accompanied by the applicant's protest
- ☐ No protest accompanied the payment of additional search fees

The International Searching Authority has determined that this international application contains multiple (groups of) inventions, as follows:

1. Claims 1-8

Method for the mutual contacting of two wafer-like component composite arrangements consisting of a number of connected similar components, the wafers being applied in a cover layer and the contact metallisations thereof being contacted by means of laser radiation. The method does not have to be carried out using the device specified in claim 9. Nor does it concern a sensor unit comprising a substrate with through-connections.

2. Claims 9-16

Device that is suitable for the mutual contacting of two wafer-like component composite arrangements, comprising a receiving area for receiving the first component composite arrangement, a transparent plate and a diode laser composite arrangement.

3. Claims 17-23

Component composite consisting of two mutually contacted wafer-like component composite arrangements, with a first transparent component composite arrangement consisting of a number of connected transparent cover units and with a second component composite arrangement consisting of a number of connected sensor units, each comprising at least one sensor which is contacted on a substrate unit of a sensor unit, which is provided with through-contacts for backwards contact access to the sensor unit (64). The component composite can be produced using the method as per claims 1-8.

(This wording, however, lends the subject matter of claim 17, insofar as it concerns specific product features, merely the feature whereby the two wafers are contacted by means of a metallisation (see the PCT Guidelines, PCT/GL/ISPE/1, 5.26, 5.27).)

## INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No.

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Patent document cited in search report		Publication date		Patent family member(s)	Publication date
EP 1346949	A	24-09-2003	US	2003170966 A1	11-09-2003
DE 4234342	A1	14-04-1994	DE	4316829 A1	24-11-1994
DE 19751487	A1	02-06-1999	WO	9926753 A1	03-06-1999
			EP	1032482 A1	06-09-2000
			JP	2001523585 T	27-11-2001
			US	6394158 B1	28-05-2002

# PATENT COOPERATION TREATY

## PCT

### INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY (Chapter I of the Patent Cooperation Treaty)

(PCT Rule 44bis)

Applicant's or agent's file reference PAC-021-WO	<b>FOR FURTHER ACTION</b>		See item 4 below
International application No. PCT/DE2004/002643	International filing date (day/month/year) 02 December 2004 (02.12.2004)	Priority date (day/month/year) 03 December 2003 (03.12.2003)	
International Patent Classification (8th edition unless older edition indicated) See relevant information in Form PCT/ISA.237			
Applicant PAC TECH- PACKAGING TECHNOLOGIES GMBH			

- This international preliminary report on patentability (Chapter I) is issued by the International Bureau on behalf of the International Searching Authority under Rule 44 bis.1(a).
- This REPORT consists of a total of 13 sheets, including this cover sheet.  
  
In the attached sheets, any reference to the written opinion of the International Searching Authority should be read as a reference to the international preliminary report on patentability (Chapter I) instead.
- This report contains indications relating to the following items:
 

<input checked="" type="checkbox"/> Box No. I	Basis of the report
<input type="checkbox"/> Box No. II	Priority
<input type="checkbox"/> Box No. III	Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
<input checked="" type="checkbox"/> Box No. IV	Lack of unity of invention
<input checked="" type="checkbox"/> Box No. V	Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
<input type="checkbox"/> Box No. VI	Certain documents cited
<input type="checkbox"/> Box No. VII	Certain defects in the international application
<input checked="" type="checkbox"/> Box No. VIII	Certain observations on the international application
- The International Bureau will communicate this report to designated Offices in accordance with Rules 44bis.3(c) and 93bis.1 but not, except where the applicant makes an express request under Article 23(2), before the expiration of 30 months from the priority date (Rule 44bis.2).

The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland  Facsimile No. +41 22 338 92 70 Form PCT/IB/373 (January 2004)	Date of issuance of this report 29 August 2006 (29.08.2006)
	Authorized officer  Elien Moysse  e-mail: p05@wipo.int

# PATENT COOPERATION TREATY

TRANSLATION

From the  
INTERNATIONAL SEARCHING AUTHORITY

PCT

WRITTEN OPINION OF THE  
INTERNATIONAL SEARCHING AUTHORITY

(PCT Rule 43bis I)

To:

Date of mailing (day/month/year) **See form PCT/ISA/210**

Applicant's or agent's file reference <b>PAC-021-WO</b>		FOR FURTHER ACTION See paragraph 2 below	
International application No. <b>PCT/DE2004/002648</b>	International filing date (day/month/year) <b>02.12.2004</b>	Priority date (day/month/year) <b>03.12.2003</b>	
International Patent Classification (IPC) or both national classifications and IPC <b>H01L23/10, H01L21/50, H01L21/60, H01S5/042</b>			
Applicant <b>PAC TECH- PACKAGING TECHNOLOGIES GMBH</b>			

1 This opinion contains indications relating to the following items:

<input checked="" type="checkbox"/>	Box No I	Basics of the opinion
<input type="checkbox"/>	Box No II	Priority
<input type="checkbox"/>	Box No III	Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
<input checked="" type="checkbox"/>	Box No IV	Lack of unity of invention
<input checked="" type="checkbox"/>	Box No V	Reasoned statement under Rule 43bis I(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
<input type="checkbox"/>	Box No VI	Certain documents cited
<input type="checkbox"/>	Box No VII	Certain defects in the international application
<input checked="" type="checkbox"/>	Box No VIII	Certain observations on the international application

2 FURTHER ACTION

If a demand for international preliminary examination is made, this opinion will be considered to be a written opinion of the International Preliminary Examining Authority (IPEA) except that this does not apply where the applicant chooses an Authority other than this one to be the IPEA and the chosen IPEA has notified the International Bureau under Rule 66 (lasta) that it often opinions of this International Searching Authority will not be so considered.

If this opinion is, as provided above, considered to be a written opinion of the IPEA, the applicant is invited to submit to the IPEA a written reply together, where appropriate, with amendments, before the expiration of 3 months from the date of mailing of Form PCT/ISA/220 or before the expiration of 22 months from the priority date, whichever expires later.

For further options see Form PCT/ISA/220

3 For further details, see notes to Form PCT/ISA/220

Name and mailing address of the ISA/IEP	Authorized official
Signature	Telephone No.

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PCT/DE2004/001648

Box No. I Basis of this opinion

1. With regard to the language, this opinion has been established on the basis of the international application in the language in which it is in which, unless otherwise indicated under this item:

☐

This opinion has been established on the basis of a translation from the original language into the following language:

\_\_\_\_\_ which is the language of a translation furnished for the purposes of international search under

Rule 17.3 and 23.1(b).

2. With regard to any nucleotide and/or amino acid sequence disclosed in the international application and necessary to the claimed invention, this opinion has been established on the basis of:

a. type of material

☐

a sequence listing

☐

tables related to the sequence listing

b. format of material

☐

in written format

☐

in computer readable form

c. time of filing/furnishing

☐

contained in the international application as filed

☐

filed together with the international application in computer readable form

☐

furnished subsequently to this Authority for the purposes of search

3. ☐ In addition, in the case that more than one version or copy of a sequence listing and/or tables relating thereto has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that in the application as filed or does not go beyond the application as filed, as appropriate, were furnished

4. Additional comments:



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Box No. IV Lack of unity of invention

- 1 ☒ In response to the invitation (Form PCT/ISA/2006) to pay additional fees the applicant has:
- ☐ paid additional fees.
  - ☐ paid additional fees under protest
  - ☒ not paid additional fees.
- 2 ☐ This Authority found that the requirement of unity of invention is not complied with and chose not to invite the applicant to pay additional fees.
- 3 This Authority considers that the requirement of unity of invention as set forth in Rules 13.1, 13.2 and 13.3 is:
- ☐ complied with
  - ☒ not complied with for the following reasons:

See supplemental sheet

- 4 Consequently this opinion has been established in respect of the following part(s) of the international application:

- ☐ all parts
- ☒ the parts relating to claims Nos. 1-9

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INTERNATIONAL SEARCHING AUTHORITY

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Box No. V Reasoned statement under Rule 43bis (b) (ii) with regard to novelty, inventive step or industrial applicability: citations and explanations supporting such statement

1 Statement			
Novelty (N)	Claims	1-8	YES
	Claims	1, 2	NO
Inventive step (SI)	Claims	3	YES
	Claims	1, 2, 4-8	NO
Industrial applicability (IA)	Claims	1-8	YES
	Claims		NO

2 Citations and explanations.

5.1 Reference is made to the following documents:

- D1: Yi Tao et al, "Investigation of Laser assisted Bonding for MEMS packaging", International Journal of Nonlinear Sciences 3, 427-431, 2002
- D2: EP-A-1 346 949
- D3: U. Mescheder et al., "Local laser bonding for low temperature budget", Sensors and Actuators A 97-98 (2002), 422-427
- D4: DE-A-42 34 342

5.2 D1 discloses a method for mutual contact-connection of two wafer-type component composite arrangements comprising a multiplicity of contiguously formed components of identical type, in particular a semiconductor wafer with a functional component wafer, for the production of electronic assemblies at the wafer level, in which the two component composite arrangements each provided with contact metallizations on their contact surfaces lying opposite one another are brought to an overlay position in order to form contact pairs with their contact metallizations, in which overlay position

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Box No. V

Reasoned statement under Rule 4bis(1)(a) with regard to novelty, inventive step or industrial applicability:  
citations and explanations supporting such statement

the contact metallizations that are to be connected to one another are pressed against one another and the contact metallizations are contact-connected by laser radiation being applied rearward to one component composite arrangement, the wavelength of the laser radiation being chosen in a manner dependent on the absorbance of the component composite arrangement subjected to rearward application such that transmission of the laser radiation through the component composite arrangement subjected to rearward application essentially does not occur or the laser radiation is essentially absorbed in the contact metallizations of one or both component composite arrangements.

Therefore, the subject matter of claim 1 (in so far as it is clear, see Box VIII) is not novel (PCT Article 33(2)).

5.3 The subject matter of claim 1 (in so far as it is clear, see Box VIII) is likewise known from D7 (see paragraphs 2, 10, 18-23, 28, 32, figure 2). The subject matter of claim 1 (in so far as it is clear, see Box VIII) is likewise known from D8.

5.4 Claims 2, 4-8 are dependent on claim 1 and therefore likewise meet the PCT requirements for novelty and inventive step.

5.4.1 The subject matter of claim 4 is known from D1-D8.

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PGI. DE2604/00.648

Box No. V

Reasoned statement under Rule 43bis. II(a) with regard to novelty, inventive step or industrial applicability, citations and explanations supporting such statement

5.4.2 D4 discloses a method for material processing by means of laser radiation, a multiplicity of laser diodes which are coupled in a suitable manner to form a laser diode array being provided for generating the laser radiation. It is obvious to a person skilled in the art to use such a laser diode array in the method known from D1, D2 or D3 in order to increase the productivity of the bonding method. The measure of activating the laser diodes individually or in groups concerns a minor modification of the known method and is obvious to a person skilled in the art. Therefore, the subject matter of claim 4 does not involve an inventive step. The additional features of claims 5-8 concern conventional measures in the present technical field.

5.4.3 The combination of features contained in dependent claim 3 is neither known from or suggested by the available prior art. The reasons are as follows: the prior art gives no indication to a person skilled in the art to form the metallizations in different sizes.

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Box No. VIII Certain observations on the international application

The following observations on the clarity of the claims, description, and drawings are on the question whether the claims are fully supported by the description, as made:

- 8.1 The application does not meet the requirements of PCT Article 6 because claim 1 is not clear.

The expression "essentially" in claim 1 is vague and unclear and leaves the reader uncertain as to the meaning of the technical feature in question. The subject matter of the claim cannot, therefore, be clearly differentiated from the prior art (PCT Article 6; guidelines PCT/GL/ISPE/1, 5.38).

WRITTEN OPINION OF THE  
INTERNATIONAL SEARCHING AUTHORITY

International application No.

821/DE2034/007148

Supplemental Box

In case the space in any of the preceding boxes is not sufficient:

Continuation of

BOX IV

4.) This authority has determined that the international application contains multiple inventions or groups of inventions which are not linked by a single general inventive concept (PCI Rule 13.1), namely:

I. Claims 1-8. Method for mutual contact-connection of two wafer-type component composite arrangements comprising a multiplicity of contiguously formed components of identical type by means of laser bonding, the wafers being brought to an overlay position, and their contact metallizations being contact-connected by means of laser radiation, the laser radiation being absorbed in the contact metallizations of the component composite arrangement to which laser radiation is applied rearward and in the contact metallizations of the opposite component composite arrangement, the area of which is greater than that of the contact metallizations of the component composite arrangement to which laser radiation is applied rearward.

II. Claims 9-16. Apparatus suitable for producing a mutual contact-connection of two wafer-type component composite arrangements, comprising a receivable frame for receiving the first component composite arrangement, comprising a transparent plate, comprising a diode laser composite

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Supplemental Box

arrangement for laser bonding.

III. Claims 17-23. Device composite comprising two wafer-type component composite arrangements that are contact-connected to one another, with a first transparent component composite arrangement comprising a multiplicity of contiguously formed transparent cover units and a second component composite arrangement comprising a multiplicity of contiguously formed sensor units each having at least one sensor which is in each case contact-connected on a substrate unit of a sensor unit which is provided with plated-through holes for a rearward contact access to the sensor unit (64). The device composite *can be produced* by the method according to claims 1-8.

(However, this wording confers on the subject matter of claim 17, in so far as concrete product features are involved, merely the feature that the two wafers are contact-connected to one another by means of a metallization (see PCT guidelines PCT/GL/ISPE/1, 5.26, 5.27).)

4.2 The reasons are as follows:

The search yielded the following prior art relevant to the assessment of unity of invention:

D1: Yi Tao et al, "Investigation of Laser-Assisted Bonding for MEMS packaging", 2002

D2: EP-A-1 346 949

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Supplemental Box

Document D1 discloses a method according to claims 1 and 2 of the present application. Document D2 (see paragraphs 2, 10, 18-23, 25, 32, figure 2) likewise discloses a method according to claims 1 and 2 of the present application.

- 4.3 A comparison of the present groups of claims with said document reveals that the following features contribute to the prior art and therefore cannot be regarded as special technical features according to PCT Rule 13.2:

Group I: The contact metallizations of the component composite arrangement to which laser radiation is not applied are larger in terms of area than those of the component composite arrangement to which laser radiation is applied rearward.

Group II: The apparatus has a diode laser composite arrangement for laser bonding and a positioning device.

Group III: Device composite comprising a substrate unit having plated-through holes for a rearward contact access of the sensor.

The method according to claim 1 need not be carried out by means of the apparatus presented in claim 9. The resultant device composite likewise need not necessarily be the one which is claimed in claim 1 (device composite comprising a sensor unit, comprising transparent cover units and comprising a substrate with plated-through holes).



Supplemental Box

- 4.4 The following may be regarded as problems solved by the special technical features:

Group I: Simultaneous input of heat into both metallizations (see page 4, lines 9-22).

Group II: In an apparatus for bonding together two wafer-type component composite arrangements, the problem is to direct the laser radiation precisely and repeatedly on to the metallizations (see page 1, line 8).

Group III: A hermetically sealed sensor unit (see figure 5 and associated description).

These problems differ from one another or are known in the prior art:

The general problem of the present application (see page 2, lines 21-25) is known from D1 and D2, namely that of ensuring during the production of wafers bonded to one another that a permissible temperature loading on the components is not exceeded.

- 4.5 There is no corresponding technical effect within the meaning of PCT Rule 13.2 between these groups. It therefore emerges that a technical relationship among the inventions involving a single general inventive concept cannot be established on the basis either of the problem addressed by the respective invention or of the solutions to said problem defined by the special technical features of each invention.

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Supplemental Box

4.6 Consequently, there is no unity of invention according to PCT Rule 13.1 and 13.2 between the groups of claims mentioned either with regard to the special technical features or with regard to the problems solved.